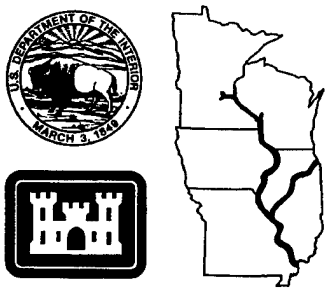

Long Term Resource Monitoring Program

Special Report

97-S003

Large Floodplain Rivers as Human Artifacts: A Historical Perspective on Ecological Integrity

December 1997

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Dear LTRMP Participant:

I am enclosing "Large floodplain rivers as human artifacts: A historical perspective on ecological integrity" by Philip V. Scarpino of Indiana University, Department of History. This report is based on a presentation given by Dr. Scarpino at the Environmental Management Technical Center-sponsored conference "Sustaining the Ecological Integrity of Large Floodplain Rivers" held in July 1994 in La Crosse, Wisconsin. The opinions and conclusions in the report are those of the author and do not necessarily reflect those of the U.S. Geological Survey, Environmental Management Technical Center.

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Sincerely,

Robert L. Delaney
Center Director

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LTRMP Special Report 97-S003

Large Floodplain Rivers as Human Artifacts: A Historical Perspective on Ecological Integrity

by

Philip V. Scarpino

Indiana University, Department of History
425 University Boulevard
Indianapolis, Indiana 46202

Project Leader:
Ken Lubinski

December 1997

Prepared for
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Environmental Management Technical Center
575 Lester Avenue
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Contents

Foreword

The author is an environmental historian and is author of *Great River and Environmental History of the Upper Mississippi*, (University of Missouri Press, Columbia, Missouri; The Indiana University Press, Bloomington). The present report was delivered at a conference on Sustaining the Ecological Integrity of Large Floodplain Rivers, held July 1994 at La Crosse, Wisconsin. The report has been slightly revised and edited for publication.

Preface

The Long Term Resource Monitoring Program (LTRMP) was authorized under the Water Resources Development Act of 1986 (Public Law 99-662) as an element of the U.S. Army Corps of Engineers' Environmental Management Program. The LTRMP is being implemented by the Environmental Management Technical Center, a U.S. Geological Survey science center, in cooperation with the five Upper Mississippi River System (UMRS) States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin. The U.S. Army Corps of Engineers provides guidance and has overall Program responsibility. The mode of operation and respective roles of the agencies are outlined in a 1988 Memorandum of Agreement.

The UMRS encompasses the commercially navigable reaches of the Upper Mississippi River, as well as the Illinois River and navigable portions of the Kaskaskia, Black, St. Croix, and Minnesota Rivers. Congress has declared the UMRS to be both a nationally significant ecosystem and a nationally significant commercial navigation system. The mission of the LTRMP is to provide decision makers with information for maintaining the UMRS as a sustainable large river ecosystem given its multiple-use character. The long-term goals of the Program are to understand the system, determine resource trends and effects, develop management alternatives, manage information, and develop useful products.

This report was prepared under Goal 1, *Develop a Better Understanding of the Ecology of the Upper Mississippi River System and its Resource Problems*, of the Operating Plan (USFWS 1993).

Large Floodplain Rivers as Human Artifacts: A Historical Perspective on Ecological Integrity

by

Philip V. Scarpino

Abstract

The great floods of 1993 on the Upper Mississippi and the Missouri Rivers put rivers and their floodplains in the national spotlight. Two facts become clear: (1) Along with the tragedy the floods created came an unprecedented opportunity for reassessing the attitudes and policies that have long shaped the relations between people and rivers. (2) These floods represented the consequences of the historical interaction between people and rivers. These floods helped to emphasize that the present is a product of the past. Historical analysis suggests at least two items worth considering by those interested in managing large floodplain rivers. First, sustaining the ecological integrity of large floodplain rivers requires a clear understanding of what it is we wish to sustain. Second, ecology had its greatest effect on public opinion and public policy when it was effectively popularized by members of the scientific community and when it was bound to a set of attitudes and values that helped to define and shape the relation between people and nature. This paper provides a general look at large floodplain rivers from a historical perspective.

Introduction

The great floods of 1993 on the Upper Mississippi and the Missouri Rivers put rivers and their floodplains in the national spotlight. Two things occurred to me about these floods: First, along with the tragedy they created came an unprecedented opportunity for reassessing the attitudes and policies that have long shaped the relations between people and rivers. One of many signs that this opportunity may be seized is a draft report of the Interagency Floodplain Management Review Committee, titled Sharing the Challenge: Floodplain Management into the Twenty-first Century (M. Reuss, U.S. Army Corps of Engineers, Alexandria, Virginia, unpublished report). Second, I was impressed by the degree to which these floods represented the consequences of the historical interaction between people and rivers. While people had no control over the amount of precipitation that fell, a host of past actions influenced such variables as the height of the crests and the magnitude of the damage (Myers and White 1993).

The floods of 1993 helped to emphasize that the present is a product of the past. Both the environments of large floodplain rivers and the concept of "ecological integrity" have important historical dimensions. Historically, large floodplain rivers have been so extensively modified by the actions of people that they have become human artifacts; they are as much the products of human attitudes and actions as they are natural systems. Although large floodplain rivers have been extensively modified worldwide, the problems and the solutions are not the same everywhere. Attitudes and values are the bottom line in human interaction with the environment; attitudes and values are rooted in culture. Therefore, successful management of large floodplain rivers requires paying as much attention to the diversity of cultures as it does the diversity of nature.

The science of ecology also has a long history, and much like large floodplain rivers, it has undergone considerable change in the past century or so (Worster 1977). Somewhat ironically, we call upon ecology, which is a human construction intended to explain nature, to help us sustain the integrity of river systems that are no longer very natural. One of the key questions before us is how to frame an explanation of ecological integrity that will empower citizens and capture the attention of policy makers. The historian can contribute by placing the idea of the ecological integrity of large floodplain rivers in historical context. Understanding the journey that we have taken to arrive at the present not only can provide insights into present relations with

large floodplain rivers, but also can help scientists, policy makers, and the interested public chart a course into the future. I restrict my discussion to an overview and draw most of my examples from the Upper Mississippi and the Missouri Rivers.

Today, in both form and function, the Upper Mississippi and the Missouri Rivers are the end products of a long process of human use and development. In one of the great ecological transformations of the nineteenth century, farmers with steel plows broke the sod of the prairies (Cronon 1991), and loggers cut the great pineries at the headwaters of the Mississippi River (Fries 1951; Hidy et al. 1963; Twining 1975; Williams 1989). This alteration of terrestrial systems had a significant effect on the Upper Mississippi and the Missouri Rivers, and their tributaries in areas such as runoff, flow rates, silt loads, turbidity, and the composition of species. Starting in the late 1890s, channel improvements for navigation further modified both rivers, although the strategies and the end products were rather different. To produce a reliable navigation channel, the Army Corps of Engineers straightened and narrowed the Missouri River. On the Mississippi River, however, the Corps ultimately constructed a series of locks and dams, which created slack-water pools with adjacent overflow lands. The growth of cities and towns and industrial development added sewage and industrial wastes to the silt in the rivers. Further modification took place with the drainage of overflow lands: the construction of parallel transportation systems in the form of railroads and highways, attempts to floodproof the rivers, dredging to maintain navigation channels, and the intentional and accidental introduction of exotic species from common carp (*Cyprinus carpio*) to zebra mussels (*Dreissena polymorpha*; Scarpino 1985).

The transformation of the Upper Mississippi and the Missouri Rivers that took place between the mid-nineteenth and the mid-twentieth centuries was solidly rooted in attitudes—in the way that many Americans defined nature and the appropriate relation between humans and nature. In this way, rivers served as a metaphor for the larger American environmental experience. Most people considered nature and the products of nature, such as crops, lumber, fish, and furs, to be a grab bag of marketable commodities (Cronon 1983, 1991; Scarpino 1994). Indeed, much of the history of navigational improvements on the Upper Mississippi and the Missouri Rivers represented a quest to develop the means for transporting the products of ecosystems to markets.

Other significant and corollary attitudes included the belief that nature was divinely created to serve human needs; that improving nature was a measure of progress; that to be improved, nature had to be conquered and controlled; that nature's bounty and its ability to absorb wastes were limitless; and that nature could be divided into good and bad according to human definitions of utility (Scarpino 1994). These attitudes had a tremendous influence on the way people used and developed the Upper Mississippi and Missouri Rivers, as well as other large floodplain rivers in the United States.

In the late nineteenth century the conservation movement emerged, largely as a response to the unintended and unanticipated consequences of acting on this cluster of attitudes toward nature (Hays 1959). Rivers played a prominent role in the conservation movement in the first half of the twentieth century. During the Progressive Era in the first two decades of the twentieth century and again during the New Deal in the 1930s, multiple-purpose river basin development represented the capstone of conservation practice. The idea was that whole river systems could be fully controlled so as to coordinate and maximize the use of benefits, and at the same time, minimize waste. Those who created the concept of multiple-purpose river basin development in the early twentieth century did so in concert with a constituency of advocates of navigational improvement, including proponents of a Lakes-to-the-Gulf deep waterway. The culmination of multiple-purpose river basin development came with the creation of the Tennessee Valley Authority in 1933 (McCraw 1971) and continued with the construction of the Tennessee–Tombigbee Waterway (Stine 1993) between the mid-1970s and the mid-1980s.

The formation of the Izaak Walton League of America by a group of businessmen from Chicago in 1922 also produced an extraordinary flowering of conservation. By 1924, the League had more than 100,000 members and had successfully lobbied Congress to establish the Upper Mississippi River Wildlife and Fish Refuge (UMRWFR). The trigger for the campaign to set up the UMRWFR was a threat to drain the Winneshiek bottoms, an area of overflow lands in northeastern Iowa and southwestern Wisconsin. In fact, the men who flocked to the League, and the various women's groups that supported them, were broadly concerned about preserving the opportunity for outdoor recreation, hunting, and fishing in the face of rapid urbanization and industrialization (Scarpino 1985). It is no accident that the League was founded in Chicago or that the UMRWFR was easily accessible by train from that city.

In the first half of the twentieth century, conservationists maintained a broad ideological spectrum, which accommodated perspectives as different as those expressed by John Muir and Gifford Pinchot. Even so, the center of the conservation movement, which included Federal agencies charged with improving large floodplain rivers, represented a limited shift in values from a belief in boundless abundance to prevention of waste and wise use of resources. These conservationists still considered people to be superior to nature and regarded nature as an assortment of useful and useless species. They also believed that the conquest and control of nature was a measure of progress (Nash 1967).

Before the 1930s, for example, scientists working for the U.S. Bureau of Fisheries on the Upper Mississippi River generally viewed the river as a medium in which to grow commercially useful species of fish and mussels. Their interest in mussels stemmed directly from the belief that overuse threatened the existence of an important industry that utilized the shells of some species for making buttons. Researchers such as M. M. Ellis sought to gain as much control as possible over the reproductive cycle of mussels and the vagaries of nature, to sustain and augment populations of useful species. In 1930, Ellis declared success; in so doing, he claimed that he placed absolute control in the hands of fishery scientists by developing a method of propagation that avoided "the prodigal waste of nature's seeding" (Ellis 1930, as cited by Scarpino 1985).

While much of the conservation movement was generally compatible with long-held attitudes about the relation between people and nature, the science of ecology posed a fundamental challenge to those same attitudes. Although there is a useful body of scholarship on the history of ecology, little of that literature explicitly connects the story of ecology to that of large floodplain rivers. It is clear that before World War II, ecology developed largely in the domain of specialists, and with few exceptions had little effect on the public or on the policies developed by Federal or State governments for the management of large floodplain rivers.

The real effect of the science of ecology did not occur until after World War II, when a popularized version of ecology provided both the scientific and philosophical underpinnings for the modern environmental movement. Scientists such as Aldo Leopold, Rachel Carson, and others not only popularized the science of ecology as it existed at that time but a system of attitudes and values as well (Sears 1935; Leopold 1949; Carson 1962a, b; Ehrlich 1969; Commoner 1971; Hays 1987) . The popularized science of ecology described the natural world as an interconnected and interdependent web of life; the attitudes and values suggested what people needed to do to sustain the health of the system of which they were a part. Both Rachel Carson and Aldo Leopold understood that sustaining ecological integrity was not only a matter of good science and sound policies but also of changing deep-seated attitudes toward nature.

The combination of the science of ecology and the philosophical outlook that went along with it created a transformation in thinking about the relation between people and nature. Indeed, the popularization of ecology represents one of two great intellectual divides in the way people thought about the natural world in the past 150 years or so; the other being Charles Darwin's contributions to evolution. In the twentieth century, the developing science of ecology helped reconcile the union of evolution and biology that had been fractured by the debate over creationism.

As the ecology-based environmental movement gained momentum in the decades after World War II, rivers became important battle grounds among groups with conflicting sets of attitudes towards the relation between people and nature. The first great post-World War II environmental battle raged between 1950 and 1956 over damming the Green River near Dinosaur National Monument in Utah (Nash 1982; Brower 1990). Protracted controversies took place in the 1970s over the Meramec Park Dam, proposed for the Meramec River, which empties into the Mississippi River near St. Louis, and the replacement of Locks and Dam 26, near Alton, Illinois, on the Mississippi River (Dobney [n.d.]; Jackson 1984; Merritt 1984).

These and dozens of other conflicts during the 1960s, 1970s, and 1980s varied according to local issues; with few exceptions, however, they were bound together by deep-seated differences over the highest use of rivers. Individuals who subscribed to pre-World War II conservationist ideas about the use and development of rivers found themselves challenged by environmentalists who embraced a post-World War II ecological perspective (McPhee 1971). Advocates of a traditional conservationist approach, including the Army Corps of Engineers and the Bureau of Reclamation, argued for the benefits of damming and otherwise regulating and controlling rivers in the name of progress and economic growth. Environmentalists, who were motivated by an ecological perspective, contended just as passionately for the benefits of free-flowing rivers and a diversity of species.

These battles over rivers demonstrate how fundamentally the ecology-driven environmental movement changed the way that many defined the relation between people and nature. In this respect, rivers continued to serve as a metaphor for the broader American environmental experience. Presently, after more than four decades of protracted controversy over how to manage large floodplain rivers, the conservation and environmental perspectives coexist in uneasy rapprochement. The seams of this union are far from perfect, which is a reflection of the mismatched parts out of which it is made.

Since World War II, the science of ecology and ecology as a popular idea have followed different developmental paths—a trend that has had a significant effect on the ability of the science of ecology to influence public policies for the management of large floodplain rivers. Ecological science has evolved in a direction that was increasingly inaccessible to the public and that was not directly linked to attitudes about the relation between people and nature. Recently, for example, the ecology of chaos has looked askance at the idea of order and harmony in nature (Worster 1990). This is a far cry from the ecosystem idea that fired the environmental movement and inspired the paradigm used by environmental historians and many other humanists for decades. Historian Worster (1990) also noted that "a survey of recent ecology textbooks shows that the concept [of ecosystem] is not even mentioned in one leading work and has a much diminished place in the others."

While the developmental trajectory of ecological science has carried it beyond the realm of public discourse, the popularized and philosophical dimensions of ecology have become fragmented into "shallow ecology," "deep ecology," "ecofeminism," "biocentrism," and several other "isms" (Sessions 1987; Merchant 1989; Diamond and Orenstein 1990). Even though public concern over the environment may be at an all-time high, I believe there is no corresponding understanding of the science of ecology among the general public.

This uncertainty over the meaning and significance of ecology provides an opening for further confusion, as in a recent syndicated editorial by Alston Chase (1994), in which he linked "biocentrism" and "ecosystems" and declared that the idea of ecosystems was "bogus." Chase stated that "while there are many reasons to protect land, water, and wildlife, saving ecosystems isn't one of them. Ecosystems are mathematical tools used to analyze energy feedback loops. You can't draw them on maps." Although I disagree with Mr. Chase's political and environmental philosophies, his argument about the irrelevance of ecosystems needs to be seen as an unwelcome but consistent extension of the recent history of ecology. As ecology has evolved in the last 40 years, it has become increasingly specialized, less accessible to the public, and estranged from the

philosophical component advocated by scientists like Aldo Leopold and Rachel Carson. Ultimately this trend could endanger the all-important public constituency needed for sustaining the ecological integrity of large floodplain rivers—a public constituency not only informed by ecology but also inspired by a set of attitudes and values that give meaning and purpose to using science to manage our relation with rivers.

As a historian, I am uneasy about drawing quick and simple lessons from the past; however, historical analysis suggests at least two items worth considering by those interested in managing large floodplain rivers. First, sustaining the ecological integrity of large floodplain rivers requires a clear understanding of what it is we wish to sustain. The history of human interaction with rivers such as the Upper Mississippi and the Missouri Rivers has been one of constant and accelerating change. By the 1990s, these rivers have become heavily modified, cyborg-like environments composed of an interconnected and interdependent web of natural and artificial parts. The best that can be done with highly humanized systems like these is to employ ecology to manage ongoing change. Given the limitations of resources, technology, and political will, there is no returning them to what they once were—even if we could decide what that should be. A key question becomes, What qualities do we wish to mitigate, enhance, preserve, and protect, and how will the science of ecology help forge public policies to do that?

A second issue has to do with ecology itself. One of the things that the floods of 1993 have done is to create a window of opportunity for reconnecting the science and philosophy of ecology in the public debate over the management of rivers. On the one hand, taking advantage of that opportunity holds out the potential for using ecology to develop policies for sustaining large floodplain rivers far into the future. On the other hand, the alternative may bring us perilously close to Alton Chase's (1994) dark view of ecology as a mathematical model "used to analyze energy feedback loops."

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